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HYDROPSYCHE BRUNNEIPENNIS, NEW SPECIES, A MEMBER OF THE *SCALARIS* GROUP, FROM THE POTOMAC RIVER NEAR WASHINGTON, D.C. (TRICHOPTERA: HYDROPSYCHIDAE)

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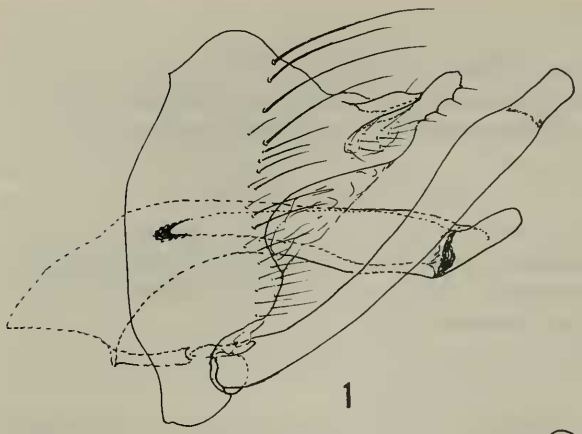
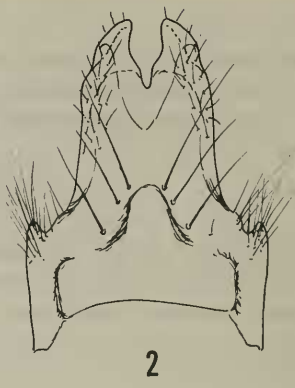
Abstract.—*Hydropsyche* ***brunneipennis***, n. sp., a newly discovered member of the *scalaris* group most closely related to *H. phalerata* Hagen and *H. aerata* Ross, is described from adult males and females and larvae. The larvae are commonly found on large rocks in fast water in the Potomac River above Washington, D.C. A list of associated species of Trichoptera and a summary of physico-chemical data are presented.

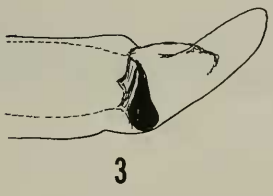
Despite recent (Flint et al., 1979) attempts to revise the *scalaris* group of *Hydropsyche* from the Mid-Atlantic states, new species are still being discovered. Surveys (by WLB) of the benthos of the Potomac River at several localities near Washington produced a distinctive larval form suggestive of *H. aerata* Ross or *H. phalerata* Hagen, but seemingly different from both. Fortunately male metamorphotypes were obtained and these were likewise suggestive of the aforementioned species, but seemed different. A search of the National Collection (by OSF) for adults of this form was unsuccessful, although there were many collections of *phalerata* made along the Potomac River in the early 1900's. Finally we visited the site at Carderock, Montgomery County, Maryland, with a portable ultraviolet light on a warm August evening. Shortly after dark when we turned on the light we were inundated by swarms of caddisflies, including many species of *Hydropsyche*. One species was quickly distinguished because of its distinctive pale brown color, exceedingly long antennae, and rather small size. The following day this species, when examined under the microscope, was found to have genitalia matching those of the male metamorphotypes.

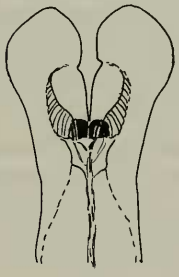
The species was clearly different from *phalerata*, with which it coexists at most of these sites. *Hydropsyche aerata* with its large, bulging eyes in the male seemed to be quite different, as was soon confirmed upon receipt of borrowed topotypes. It was clear that one of the present-day, common, species of *Hydropsyche* near Washington was without a name!

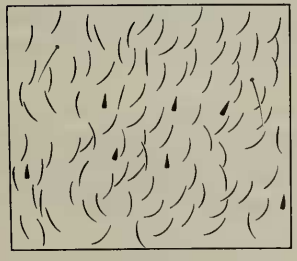
The adult and larva are described, and ecological notes are given for the type-locality. The posterior aspect of the clasper and the ventral aspect of the tip of the phallus of *aerata* are also figured (Figs. 8–9) for comparison, as there is no illustration of the former and the original figure of the latter is a bit inaccurate.

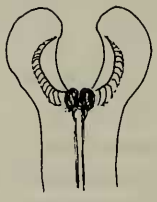




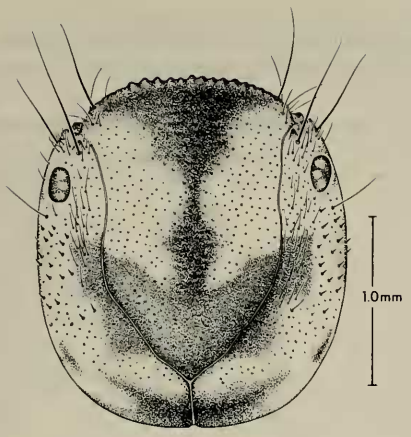








Figs. 1–9. 1–7, *Hydropsyche brunneipennis*. 1, Male genitalia, lateral. 2, Ninth and tenth terga, dorsal. 3, Tip of phallus, lateral. 4, Tip of phallus, ventral. 5, Clasper, posterior. 6, Tip of clasper, dorsal. 7, Portion of cuticle of seventh abdominal tergum of larva, showing types of setae, dorsal. 8, 9, *H. aerata*. 8, Tip of phallus, ventral. 9, Clasper, posterior.



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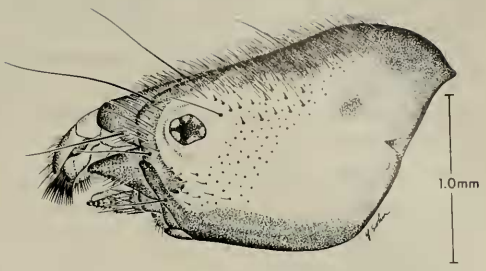

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Figs. 10, 11. *Hydropsyche brunneipennis,* larval head. 10, Dorsal aspect, small hairs removed dorsomesally to better show color. 11, Lateral aspect, with hairs.

Hydropsyche brunneipennis Flint and Butler, New Species
Figs. 1–7, 10, 11

This, the third species of the *Phalerata* subgroup, is probably most closely related to *aerata,* and more distantly to *phalerata* with which it coexists. *Hydropsyche phalerata* differs primarily in having the tip of the clasper produced into a sharp point (see, for example, Flint et al., 1979, figs. 2 or 8), the lateral plates of the phallus are much shorter, approximate on the midline and lacking the small notch. From *aerata, brunneipennis* is immediately distinguished by having small eyes (see Ross 1944, fig. 392 for eyes of *aerata*), and in having longer lateral plates of the phallus which are not so widely separated on the midline nor so evenly concave here. There do not seem to be any discernable differences in the female genitalia of *phalerata* and *brunneipennis.*

Adult.—Length of forewing, ♂ 8 mm, ♀ 7 mm. Color pale brown; head and thorax infuscate, appendages pale brown; forewing of ♂ light brown with a few slightly darker areas, of ♀ darker grayish brown, with several small light spots and 2 large pale spots on anal margin. Antenna of ♂ very long, about $1\frac{1}{2}$ as long as forewing; eyes of a ♂ small, in frontal aspect about $\frac{1}{2}$ that of interocular distance. Male genitalia: 9th segment with anterior margin nearly vertical; with a low dorsomesal crest. Tenth tergum produced into elongate apicolateral lobes, widely divided apicomesally in dorsal aspect. Clasper with basal segment long, slender, and straight; apical segment short, about $\frac{1}{5}$ length of basal segment in posterior aspect, tip darkened and truncate in all aspects. Phallus tubular, phallobase slightly enlarged apicad; lateral plate in lateral aspect sharply upturned, extending well above dorsum of phallus, in ventral aspect with mesal cavity shallow, widest basally, widely open posteriad, mesal margins of plates not touching on midline, with a distinct notch at apex of mesal cavity. Female genitalia: Clasper groove not well marked, not produced into a clasper receptacle; in dorsal aspect groove shallow, narrowest anteriorly.

Table 1. Trichoptera larvae collected by surber sampler in the Potomac River. Each figure represents the total number of specimens of the taxon from 9 surber samples, 3 taken on the Maryland side of the river, 3 taken near the middle of the river, and 3 taken at the Virginia side of the river. Data extracted from Miller et al. (1981, appendix B).

Taxa	Little Falls 20-VIII-80	Carderock 20-VIII-80	Seneca 14-VIII-80
Brachycentridae			
Micrasema sp.	1		
Glossosomatidae			
Protoptila sp.		2	
Hydropsychidae			
Cheumatopsyche spp.	291	269	769
Hydropsyche betteni Ross		1	
H. brunneipennis, n. sp.	93	845	144
H. dicantha Ross	63	5	100
H. hageni Banks	90	130	69
H. hoffmani Ross	73	187	89
H. leonardi Ross	67	37	
H. phalerata Hagen	241	390	483
H. scalaris Hagen	3	12	10
Potamyia flava (Hagen)	32	74	69
Macrostemum sp.	913	835	634
Hydroptilidae			
Hydroptila spatulata Morton	1		1
H. waubesiana Betten	4	1	
Leucotrichia pictipes (Banks)	8		
Leptoceridae			
Ceraclea spongillovorax Resh	1		11
Ceraclea sp.			2
Nectopsyche pavida (Hagen)		1	
Oecetis cinerascens (Hagen)	3		
Polycentropodidae			
Cyrnellus fraternus (Banks)	3		
Neureclipsis sp.	4	2	
Psychomyiidae			
Psychomyia flavida Hagen	1		

Larva.—Length to 8 mm, width 1.5 mm. Head yellow with fuscous pattern on dorsum, in the approximate form of a cross with a broad transverse arm, longitudinal arm expanded anteriad to cover anterior margin of frontoclypeus, posterior margin infuscate dorsally; venter fuscous. Head with scattered short, light brown, spinelike setae mostly posteriad to eye; dorsum covered densely with long, thin setae. Anterior margin of frontoclypeus convex, evenly serrate. Labrum yellow basally, infuscate apically and at posterolateral angles; with dense brushes of hair anterolaterally. Mandibles dark castaneous. Thoracic nota yellow, with fuscous lateral and posterior marks. Pronotum with scattered, short, light brown, spinelike setae, and small decumbent pale setae; anteromesally with an area of long, thin setae. Meso- and metanota with many dark, small decumbent setae. Legs yellow;

Table 2. Diversity of macrobenthos in Potomac River. Same comments and source as for Table 1. Diversity indices computed using the Shannon-Weaver Function.

Category	Little Falls 20-VIII-80	Carderock 20-VIII-80	Seneca 14-VIII-80
Total no. of organisms	3127	4523	4164
Total no. of taxa			
Generic level	47	44	46
Specific level	58	56	56
Diversity index			
Ordinal level	2.06	1.82	2.02
Generic level	3.46	3.28	3.62
Specific level	3.99	3.98	4.10

most setae concolorous, forefemur with a patch of fuscous setae ventromesally. Prosternum yellow anteriorly, fuscous posteriorly. Abdomen white, with numerous, short, dark, decumbent setae; segments 1–5 with many small spinules; a few, scattered, erect scale hairs from segment 5 posteriad. Ventral sclerites of segment 8 with black setae; sclerites of segment 9 with many, short, brown, spinelike setae and a fringe of black setae apically. Anal prolegs yellow with dark setae, except for brown, spinelike setae lateroventrally.

Material.—Holotype, ♂: USA, Maryland, Montgomery Co., Potomac River at Carderock, 27 Aug. 1981, Flint and Butler. USNM Type 100221. Paratypes: Same data, 151 ♂, 128 ♀; same, but 21 Sep. 1981, Flint and Bueno, 2 ♂, 42 ♀. Tennessee, Claiborne Co., Powell River at Buchanan Ford, 30 Jun. 1982, J. Louton et al., 1 ♂ (UTK). West Virginia, Pocohontas Co., Greenbrier River, 5 mi. north Marlinton, 29 Jun. 1982, Flint and Mathis, 2 ♂, 5 ♀.

Biology.—The immature stages have been taken in three extensive rapids upstream of Washington. The first was at Little Falls (River Mile 117.6), 0.8 miles below the water diversion dam, the second at Carderock (River Mile 122.9) in front of the Picnic Area, and the third at Seneca (River Mile 134.2) at the end of Violets Lock Road.

The Little Falls transect produced a total of 58 taxa of benthic macroinvertebrates (Table 2), with the caddisflies (19 taxa) representing 60.5% of the total number of organisms collected. *Macrostemum* sp. (probably *zebratum* (Hagen)) was the dominant caddisfly (Table 1), with *Hydropsyche brunneipennis* ranking fifth in abundance with about one-tenth the numbers of *Macrostemum*. At Carderock, 56 taxa were taken with the caddisflies (15 taxa) again dominating the assemblage at 61.7% of the numbers. Here the larvae of *brunneipennis* were the most numerous taxon, but barely surpassing those of *Macrostemum* sp. At Seneca, where there were 56 taxa collected and the caddisflies (12 taxa) still dominated with 57% of the total numbers, *brunneipennis* had dropped back in relative abundance to fourth place at about one-fifth the abundance of the dominant *Cheumatopsyche* spp. larvae. In summary the species here described is a common or even dominant one in the riffle areas of the Potomac River where it crosses the Piedmont.

The physico-chemical data presented in Table 3 indicate that the Potomac

Table 3. Summary of water quality data for Little Falls on the Potomac River, 1974–1980. Data generated by State of Maryland, Office of Environmental Programs.

Parameter	Number of samples	Maximum	Minimum	Average
Temperature (°C)	81	32.	1.7	17.7
Flow (CFS)	70	53,700	700	12,382
Hydrogen ion (pH)	81	9.9	7.3	8.2
Conductivity (μmho/cm)	86	456	110	259
Dissolved solids (mg/l)	71	1272	68	182
Suspended solids (mg/l)	76	270	1	36
Turbidity (FTU)	77	108	1.6	19.6
Dissolved oxygen (mg/l)	85	14.4	5.9	10.0
Chemical oxygen demand (mg/l)	20	30.8	2.03	10.4
Total organic carbon (mg/l)	77	37	.09	11.9
Total chlorophyll-*a* (μg/l)	78	202.5	.15	36.5
Active chlorophyll-*a* (μg/l)	44	114.9	1.07	25.15
Total hardness (mg/l $CaCO_3$)	20	167	64	105
Total acidity (mg/l $CaCO_3$)	19	30.0	1.0	9.1
Total alkalinity (mg/l $CaCO_3$)	28	148	49	77
Total Kjeldahl N (mg/l N)	74	1.00	.12	.43
Organic nitrogen (mg/l N)	78	.97	.06	.39
Ammonia nitrogen (mg/l N)	75	.25	.01	.04
Nitrite N (mg/l N)	74	.031	.002	.010
Nitrate N (mg/l N)	74	3.03	.02	.82
Total phosphorus (mg/l P)	80	.41	.02	.08
Ortho phosphate (mg/l P)	80	.18	.01	.04
Sulfate (mg/l SO_4)	28	66	0.5	29
Total Fe (mg/l)	20	.85	.05	.21

River at Little Falls is a large, warm water stream of moderate hardness with a reasonably good water quality. Mason et al. (1975) summarized the physico-chemical data for the years 1962–1973 and concluded that the water quality of this section of the river was good. Certain parameters, most notably dissolved oxygen, indicate that water quality improved during the period 1974–1980. Between 1962–1973 the dissolved oxygen concentrations went as low as 3 mg/l, but between 1974–1980 the concentration never dropped as low as the 5 mg/l lower limit for good fisheries. Although the averages are good in general, the ranges for some parameters suggest periodic water quality problems resulting from human activities. The pH may exceed the upper limit (pH 9) for adequate protection of aquatic life. Likewise the total suspended solids sometime exceed the upper limit of 80 mg/l for moderate protection of aquatic life, and, as pointed out by Miller et al. (1981), the actual maxima (unsampled) probably exceed these readings several fold. The average values of total phosphorus, nitrate nitrogen and total chlorophyll *a* all approach or exceed the levels classified as eutrophic (Mason et al., 1975).

The sampling sites can be characterized as being erosional areas of turbulent, rapid flow with substrates of bedrock and coarse sediments such as cobbles and boulders. The larvae are generally found on large boulders or bedrock in the fastest flows of the river, where their nets may form rows along a suitable niche. The generally favorable water quality and substrate is mirrored in the specific diversity

index levels of the benthic macroinverebrates (Table 2) of 3.98 (Carderock), 3.99 (Little Falls), and 4.10 (Seneca).

Acknowledgments

We acknowledge the help of J. Reese Voshell, Jr. for his aid in the analysis of the physico-chemical data. The male paratype from Tennessee was sent by D. A. Etnier, Department of Zoology, University of Tennessee, Knoxville (UKT), to whose collection it has been returned. Young T. Sohn of the Department of Entomology, Smithsonian Institution, produced the excellent figures (Figs. 8, 10, 11) of the larva of *brunneipennis*.

Literature Cited

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